ORIGINAL ARTICLE

The Malay Version of the Theory of Planned Behaviour Questionnaire on the Intention of Pre-Pregnancy Care Services Utilisation: A Validation Study

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ABSTRACT

INTRODUCTION: This study aims to translate and adapt the Theory of Planned Behaviour questionnaire on intention of pre-pregnancy care services utilisation (IPCSU) from English to Malay and determine its validity and reliability. **MATERIALS AND METHODS**: This was a cross-sectional validation study conducted at UiTM Shah Alam, Selangor, Malaysia from October to December 2022 among 145 unmarried female undergraduate students aged 18 to 25 years who could speak and understand written Malay. Participants were excluded if they were currently pregnant or had been pregnant in the past. Convenience sampling was employed for participant selection. The English version of the 25-item IPCSU questionnaire was subjected to translation, adaptation, content validation, and face validation, ; followed by field testing to create the Malay version. Psychometric analysis was performed using exploratory factor analysis, internal consistency, and test-retest reliability. **RESULTS:** A total of 145 participants (91% response rate) were recruited, with 89.7% being Malay and a mean age of 21.7 years (±SD 1.6). The scale-level content validity index/average (0.98) and scale-level face validity index/average (0.88) were acceptable. Exploratory factor analysis found that the Malay version of IPCSU had four conceptually equivalent domains, with four items removed due to a low inter-item correlation matrix. The construct validity achieved an acceptable factor loading for each construct (0.47 to 0.80). The overall Cronbach's alpha was 0.95, indicating excellent internal consistency, and the intraclass-correlation coefficient values ranged from 0.46 to 0.86, indicating moderate to excellent reproducibility. **CONCLUSION:** The Malay version of the IPCSU questionnaire is valid, reliable, and stable over time.

Keywords
Theory of Planned Behaviour, Validity and Reliability, Preconception care, Pre-pregnancy care

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INTRODUCTION

Pre-pregnancy care (PPC) provides biomedical, behavioural, and social health interventions to women and couples before conception. The goal is to enhance their health condition and minimise factors that might lead to poor maternal and child health outcomes.[1]

A growing body of evidence supports the effectiveness of PPC as an intervention to reduce maternal and perinatal mortality and morbidity. For instance, a systematic review and meta-analysis study demonstrated the beneficial impact of PPC on maternal and infant health, particularly in women with specific risk factors such as diabetes and hypertensive disorders.[2] Furthermore, PPC was associated with reduced risk of maternal and neonatal complications.[3]

However, despite this evidence, the prevalence of PPC services utilisation is low worldwide. For example, countries such as China (42%), the United States (36%), and Ethiopia (14.5%) shows a different level of PPC services utilisation, and in Iran, more than 50% of women do not engage with PPC.[4-7] The situation in Malaysia is quite similar, as evidenced by studies conducted in different regions, such as Kedah, Perak, and Bachok. [8-10]

Most studies on using PPC services mainly focused on women who are married or pregnant women with comorbidities. However, PPC should also be emphasised in healthy young adults including those who are unmarried or not pregnant. Therefore, the prevalence of the intention of PPC services utilisation in this population has yet to be discovered. We selected the Theory of Planned Behavior (TPB) to assess intention. This model effectively understands the relationship between intention and behaviours.[11] According to Ajzen's theory, a person's behaviour is determined by his or her intentions, which are determined by attitude, subjective norms and perceived behavioural control.[12]

A research gap exists in this context, as local studies have yet to report the intention of PPC service utilisation using a Malay-validated TPB questionnaire. Hence, there is a need to validate the tools. We aimed to translate and adapt the TPB questionnaire on the intention of PPC services utilisation (IPCSU) from English to Malay language and to determine the validity and reliability of the tool among female undergraduate students of Universiti Teknologi MARA (UiTM) Shah Alam.

Material and Methods

Study design and setting

This was a cross-sectional questionnaire translation and validation study conducted in three phases. Phase 1: Back-to-back translation, adaptation, and content validation of the IPCSU questionnaire from English into the Malay language; Phase 2: face validation of the Malay version of IPCSU questionnaire and phase 3: field testing and psychometric analysis of the questionnaire.

Instrument

Limited tools are available for measuring the intention of PPC services utilisation based on the TPB constructs. These tools include extended questionnaires with 61 and 51 items, respectively[13,14] and a shorter version with 25 items.[15]

Hence, the decision was made to validate the shorter version of the questionnaire because it is simpler with fewer items, and its psychometric properties are comparable to the extended version. This questionnaire was validated in Iran containing the TPB construct, which has 25 items within four domains with ten items in attitude, seven in subjective norms, five in perceived behaviour control and three in behavioural intentions domains. A five-point Likert scale (ranging from 1=totally disagree to 5=totally agree) was used for each item. Higher scores indicate a more positive attitude, subjective norms, and perceived behavior control toward PPC, as well as a stronger intention to use PPC services. The Cronbach's alpha was 0.75, 0.68, 0.77, and 0.76, respectively, and the entire tool was 0.72.[15]

Phase 1: Back-to-back translation, adaptation, and content validation

The English version of the IPCSU questionnaire was translated into Malay using international guidelines for cross-cultural adaptation to ensure the quality of the translated version and its consistency of meaning to the original version.[16] Firstly, the forward translation from English to Malay language was performed independently by two bilingual translators - an expert in linguistics and a public health medicine specialist. This was followed by a back-translation from Malay to English by another two bilingual translators who were unaware of the English version of the questionnaire. Each translator produces a report independently. The process involved addressing inconsistencies in forward and backward translations, followed by cross-cultural adaptation. This synthesis also entailed selecting easily comprehensible Malay words and culturally appropriate phrases for adaptation into Malaysian culture.

Next, a content validation was conducted by six experts (consisting of primary care medicine, public health medicine, and obstetrics and gynaecology specialists) to assess the relevance of the items in the questionnaire and provide a critical review. The content validity index (CVI) was used to determine the content validity. The CVI assesses the relevance of each item to the domain, which is item-level content validity index (I-CVI) and scale-level content validity index (S-CVI).[17] They need to evaluate each item by rating on a 4-point Likert scale in terms of the degree of relevance (1=not relevant to 4=very

relevant), clarity (1=not clear to 4=very clear), and essentiality (1=unnecessary to 4=essential). The CVI was computed by calculating the scale average. Feedback and suggestions provided by the experts were incorporated to refine the questionnaire. Changes were made to the original questionnaire to suit the study's objectives, local language, and culture. At the end of Phase 1, a preliminary Malay version of the IPCSU questionnaire was produced.

Phase 2: Face validation

The preliminary Malay version of the IPCSU questionnaire went through a process of face validation on the target population by convenience sampling. It was pre-tested on 30 eligible students according to the inclusion and exclusion criteria. The inclusion criteria included unmarried female undergraduate students from UiTM Shah Alam aged 18-25 who could speak and understand the written Malay language. Participants who were currently pregnant or had been pregnant in the past were excluded from the study, as were those who did not provide informed consent. The face validity index (FVI) was used to determine the face validity, which can be quantified as item-level face validity index (I-FVI) and scale-level face validity index (F-CVI).[18] The face validation was conducted to assess their understanding of the questionnaire's wording, content, and overall structure. They were required to rate each item according to the 4-point Likert scale in terms of degree of clarity and comprehensibility (1=not clear and not understandable to 4=very clear and understandable). The FVI was computed by calculating the scale average. Correction and fine-tuning of the preliminary Malay version of the IPCSU questionnaire by the research team was done based on the respondent's feedback. This revised Malay version of the IPCSU questionnaire went through a second face validation by another 30 students from UiTM Shah Alam. The feedback indicated that the questionnaire was satisfactory, and no further amendments were required. The content and face-validated Malay version of the IPCSU questionnaire was ready for field testing.

Phase 3: Field testing and psychometric analysis

The Malay version of the IPCSU questionnaire was field-tested on students from the same setting from October to December 2022. The same inclusion and exclusion criteria were applied to select the participants. Respondents who participated in Phase 2 and Phase 3 were mutually exclusive, as those who participated in Phase 2 were not re-selected for Phase 3 of this study. The sample size for this field testing was calculated using the subject-to-item ratio. Pallant recommended a minimum sample size according to the subject item ratio 5:1.[19] The Malay version of the IPCSU questionnaire contains 25 items. Therefore, the minimum required sample estimated was 125 participants. By considering 20% of non-responders and the non-eligibility rate, this study aimed to approach 150 participants. Convenience sampling was used to recruit the respondents. Participants were briefed face to face, and clear instructions were given on completing the questionnaires. A link for the online self-administered Malay version of the IPCSU questionnaire via Google Form was sent through a WhatsApp group. The respondents were required to give consent by selecting the "yes" option before starting the survey. The questionnaire used a proxy identifier instead of personal details to ensure the confidentiality and anonymity of the respondents. All questions were set as "required" to be answered prior to submission to avoid missing data. After two weeks, 30 participants from previously recruited participants were contacted to complete the same questionnaire for test-retest reliability analysis. The selection was based on logistic reasons.

Permission to use and translate the original TPB questionnaire on intention of PPC services utilisation into Malay was obtained from the corresponding author from Arak University of Medical Sciences, Arak, Iran.[15] The Universiti Teknologi MARA (UiTM) Research Ethics Committee has approved this study [reference:600-RMI (5/1/6)].

Statistical analysis

Data entry and statistical analysis were performed using IBM SPSS Statistics Version 25. During data entry, the

Likert Scale responses for negatively phrased questions were reversed. In the descriptive analysis, categorical variables were presented as frequency and percentages. Mean and standard deviation (SD) were reported for normally distributed continuous data.

The construct validity of the Malay version of the IPCSU questionnaire was assessed using exploratory factor analysis (EFA). There are three main steps in conducting EFA: determining the data's suitability, factor extraction, and factor rotation.[20] The suitability of data was assessed by checking the correlation coefficient among items in the correlation matrix, the Keiser-Meyer-Olkin Sampling Adequacy Test (KMO) and Bartlett's Test of Sphericity. Correlation coefficient values ranging from 0.30 to 0.90, a significant KMO value of ≥0.06 and Bartlett's Test of Sphericity with a p-value <0.05 are considered suitable for factor analysis. Principal component analysis (PCA) was used for factor extraction. Kaiser criterion (eigenvalue >1), cumulative percent of variance extracted, and Scree test were done to decide which factors to retain.[20] The orthogonal (varimax) rotation technique was performed for factor rotation, and communalities values should be greater than 0.40.[21] Factor loading was set at 0.45 according to sample size.[21,25]

The reliability of the finalised Malay version of the IPCSU questionnaire was assessed using Cronbach's alpha coefficient as a measure of internal consistency to determine the extent to which all items in a test measure the same concept. Internal consistency is "the degree of interrelatedness among the items".[26] This was done for the entire instrument and the different domains. Cronbach's alpha >0.7 suggests adequate internal consistency.[21] Corrected item-total correlation was also performed, and the effect of removing an item on Cronbach's alpha was also determined. Intraclass correlation coefficients (ICC) were used to assess the test-retest reliability of the questionnaire. Values >0.9 indicate excellent reliability, 0.75–0.90 indicate good reliability, 0.5–0.75 indicate moderate reliability, and <0.5 indicate poor reliability.[27]

RESULTS

Cross-cultural adaptation, content validity and face validity index

Table I shows the cross-cultural adaptation, content validity and face validity of the Malay version of the IPCSU questionnaire. Several changes were made to the original questionnaire to suit the study's objectives, local language, and culture in phase 1 and phase 2 of this study. The I-CVI was between 0.83 – 1, with an S-CVI/Ave of 0.98, indicating an acceptable CVI value.[17] The I-FVI was between 0.70 – 1 with an S-FVI/Ave of 0.88. FVI of at least 0.80 indicates an acceptable value.[18] There were five items with I-FVI below the cut-off value of 0.80. Thus, these items were revised to increase clarity for better understanding.

Descriptive analysis

A total of 150 respondents were approached; however, five did not fulfil the inclusion or exclusion criteria, resulting in a response rate of 91%. Consequently, 145 completed questionnaires were analysed. Most respondents were Malay (89.7%), with a mean age of 21.7 years (±SD 1.6). The sociodemographic characteristics of the participants are presented in Table II.

EFA and reliability analysis

We employed EFA to validate the underlying factor structure of the Malay version of the IPCSU questionnaire and to ensure its construct validity in the Malaysian context. EFA is a statistical technique used to identify the underlying structure of a set of variables. It does this by grouping variables that are correlated with each other and then identifying the factors that these groups of variables represent.

In our analysis, most of the correlation coefficient values among items in the correlation matrix were above 0.3, which are considered acceptable. However, we identified four items with very low inter-item correlations <0.3: two from the attitude domain and two from the subjective norms domain. Following standard practice for

Table I: The cross-cultural adaptation, content validity and face validity of the Malay version of IPCSU

TPB Construct	Item	English Version	Synthesis Changes	I-CVI of Experts (n=6)	I-FVI of Respondents (n=30)
Attitude	A1	I believe that I need to have a pre-pregnancy care checkup before I get pregnant.		1	0.90
	A2	I believe that even by reducing alcohol consumption and smoking, it cannot assure a complete healthy baby.	Order of item was rearranged to A3.	0.83	0.97
	A3	I believe that maternal nutrition before pregnancy has an effect on fetal health.	Order of item was rearranged to A2.	1	0.87
	A4	I believe that genetic counselling for hereditary diseases can cause stress to prospective parents. Therefore, I feel it is better not to pursue it.	Add "hereditary diseases" and add "prospective" from "I believe that genetic counselling is stressful for parents, so it is better not to do it".	1	0.73
	A5	There are some vaccines that should be taken before pregnancy because if taken during pregnancy, they can have harmful effects on the fetus.	Rephrased to enhance clarity from "Some vaccines are best given before pregnancy because of the bad effects on the fetus".	1	0.80
	A6	I believe that having pre-pregnancy counselling will bring benefits to the future health of my baby.		1	0.97
	A7	I believe that pre-pregnancy care can reduce the additional costs of treatment in the future.		1	0.70
	A8	I believe that by having pre-pregnancy care in the future, I can prevent pregnancy complications (miscarriage, preterm birth, etc.).		1	0.93
	A9	I disagree with pre-pregnancy care because I have never seen an unwanted pregnancy complication in my family or friends.	Rephrased to enhance clarity from "I disagree with filing a pre-pregnancy care because I have never seen an unwanted pregnancy complication in my family or friends".	1	0.70
	A10	In my opinion, pre-pregnancy care should be provided for women with medical condition.		1	0.90
Subjective Norms	SN1	I will do pre-pregnancy care if requested by the staff of health centers.		1	0.93
	SN2	I will do pre-pregnancy care because my friends had opened a maternal health record book.	Rephrased to enhance clarity from "I will do it because my friends had opened a pregnancy record book".	0.83	0.73
	SN3	I will make plans for the pre-pregnancy care if my spouse asks to.	Change husband to spouse.	1	0.90
	SN4	In my opinion Internet and the mass media (television, radio, etc.) have an important role in behaviour that promote pre-pregnancy care.		1	0.87
	SN5	The dissatisfaction of my family and spouse can hinder me from receiving pre-pregnancy care.	Rephrased to enhance clarity from "The dissatisfaction of my family and spouse can prevent me from receiving pre-pregnancy care".	0.83	0.70
	SN6	If the doctor recommends pre-pregnancy care, I will do it.		1	1
	SN7	When attending pre-pregnancy care, I will follow the recommendations of the health center staff.		1	1
Perceived Behavioral Control	PBC1	I can make plans for pre-pregnancy care even if my family disagrees.		1	0.87
	PBC2	I will do pre-pregnancy care despite my busy schedule.		1	0.90
	PBC3	I am sure that I can control high-risk behaviors (such as sedentary lifestyle, obesity, smoking or excessive alcohol intake) before pregnancy.		1	0.83
	PBC4	I will do pre-pregnancy care even the required tests (such as tests to detect genetic diseases) are expensive for me.	Add example of test.	1	0.83
	PBC5	If necessary, I certainly will do pre-pregnancy care.		1	0.90
Behavioural Intention	BI1	I will see a doctor for treatment before pregnancy if I have any diseases.		1	0.93
	BI2	I will reduce high-risk behaviors (such as sedentary lifestyle, obesity, smoking or excessive alcohol intake) before pregnancy.	Rearrange the word order.	1	0.93
	BI3	I will do pre-pregnancy care to ensure the health of my future baby.		1	0.93
			S-CVI/Ave	0.98	-
			S-FVI/Ave	-	0.88

Note: I-CVI = Item-level content validity index; I-FVI = Item-level face validity index, S-CVI/Ave = Scale-level content validity index based on the average method; S-FVI/ Ave = Scale-level face validity index based on the average method

Table II: Sociodemographic characteristics of respondents (n=145)

Variables		Total Freq, n (%)	Mean (SD)
Age			21.7 (1.61)
Ethnicity	Malay	130 (89.7%)	
	Bumiputera (Sabah/ Sarawak)	15 (10.3%)	
Income	B40	96 (66.2%)	
	Non-B40	49 (33.8%)	
Chronic disease status	No	128 (88.3%)	
	Yes	17 (11.7%)	
Genetic disease status	No	132 (91.0%)	
	Yes	13 (9.0%)	
Intention to get married	≤ 5 years	49 (33.8%)	
	> 5 years	96 (66.2%)	

determining item removal, we removed these items to ensure a robust factor structure. This threshold indicates a minimum level of relationship between items necessary for meaningful factor formation.[20]

The suitability of our data for factor analysis was strongly supported by a KMO value of 0.92 and a significant Bartlett's test ($p<0.001$). The KMO value is above the recommended 0.6, which suggests excellent sampling adequacy, while the significant Bartlett's test confirms the presence of correlations in our data matrix, indicating the sample is suitable for factor analysis.[21] After removing the four items with low inter-item correlations, 21 items were retained for the EFA.

We then performed EFA using PCA for factor extraction and varimax rotation, initially applying a minimum factor loading criterion of 0.45. This analysis resulted in a total questionnaire variance of 68.8%. We chose PCA for its efficiency in reducing data dimensionality while retaining maximum variance, and selected varimax rotation to maximize the dispersion of loadings within factors, producing a simpler, more interpretable solution. This combination is widely used in psychometric research.[22-24]

The Kaiser's criterion suggested three factors should be retained, as three factors had eigenvalues exceeding 1.0. However, the elbow of the Scree plot occurred at factor 5, suggesting that four factors should be retained.[25] Faced with this discrepancy, we carefully considered both statistical indicators and conceptual relevance. Ultimately, four factors were deemed the most conceptually appropriate for the Malay version of the IPCSU questionnaire, aligning with the underlying Theory of Planned Behavior framework, ensuring that the factor structure meaningfully represents the constructs of attitude, subjective norms, perceived behavioral control, and behavioral intention. Consequently, we reanalyzed the data by fixing the number of factors at four. The result shows that initial eigenvalues were greater than 1, and the cumulative percent of variance explained was 73.4%. All communalities on the scale were above 0.40, indicating an acceptable level. 21 Furthermore, all items demonstrated factor loadings greater than 0.45, meeting our predetermined criteria.

We set a minimum factor loading of 0.45, which is considered meaningful for our sample size of 145. This threshold ensures that each item contributes substantially to its respective factor. One item, PBC5, cross-loaded into factors 2 and 3 with values of 0.543 and 0.590, respectively. After careful consideration, we retained this item in Factor 3 as it fits better conceptually within this factor, maintaining the integrity of the TPB framework. This decision balanced statistical results with theoretical considerations. Table III provides a comprehensive overview of the EFA results for the Malay version of the IPCSU questionnaire, illustrating the factor structure and item loadings.

Table IV shows the item-total reliability analysis and Cronbach's alpha for each domain. The corrected item-total correlations ranged from 0.46 to 0.93, indicating moderate to strong correlations of the individual items to the sum scale of the questionnaire.[28] These values indicate the strength of association between individual items and the overall scale which suggest that each item contributes meaningfully to the measurement of the intended construct while not being redundant. Cronbach's alpha values above 0.70 are generally considered acceptable, indicating good internal consistency. Our values ranging from 0.88 to 0.95 for individual domains and 0.95 for the overall scale demonstrate excellent internal consistency, suggesting that the items within each domain and across the entire questionnaire are measuring the same underlying construct.[21] The deletion of any items

in the scale would not have improved Cronbach's alpha of the scale. We conducted test-retest reliability analysis with a two-week interval on a subset of 30 participants. ICC values ranged from 0.46 to 0.86, indicating moderate to excellent reproducibility. These results demonstrate the stability of the questionnaire over time, a crucial aspect of reliability in psychometric instruments.[27]

Therefore, our psychometric analysis demonstrates that the final Malay version of the IPCSU questionnaire consisting of 21 items is valid and reliable. The four-factor structure aligns with the TPB framework, and the high internal consistency and test-retest reliability indicate a stable measurement tool suitable for assessing intention to use pre-pregnancy care services in the Malaysian context.

Table III: Exploratory factor analysis of the Malay version of IPCSU

TPB Construct	Item	Factor loadings			
		1	2	3	4
Attitude	A1	0.544			
	A2	0.667			
	A3	0.528			
	A5	0.669			
	A6	0.693			
	A7	0.765			
	A8	0.701			
	A10	0.631			
Subjective Norms	SN1		0.763		
	SN3		0.469		
	SN4		0.686		
	SN6		0.802		
	SN7		0.774		
Perceived Behavioral Control	PBC1			0.720	
	PBC2			0.789	
	PBC3			0.744	
	PBC4			0.766	
	PBC5		0.543	0.590	
Behavioural Intention	BI1				0.785
	BI2				0.800
	BI3				0.795

DISCUSSION

This study aims to translate, adapt and validate the TPB questionnaire on IPCSU for use in the Malaysian context. Our results demonstrate that the Malay version of the IPCSU questionnaire exhibits strong psychometric properties. The translation and adaptation process involved careful item swapping, deletion, and rephrasing to ensure cultural appropriateness for the Malaysian context. For instance, we refined item A4 on genetic counseling to enhance clarity. Despite these

Table IV: Psychometrics of the Malay version of IPCSU

TPB Construct	Item	Cronbach's alpha	Corrected item-total correlation	Cronbach's Alpha if Item Deleted
Attitude		0.88		
	A1		.686	.864
	A2		.706	.863
	A3		.459	.891
	A5		.604	.872
	A6		.774	.855
	A7		.727	.859
	A8		.733	.859
	A10		.601	.873
Subjective Norms		0.93		
	SN1		.929	.900
	SN3		.634	.955
	SN4		.756	.932
	SN6		.904	.904
	SN7		.929	.900
Perceived Behavioral Control		0.90		
	PBC1		.745	.886
	PBC2		.847	.865
	PBC3		.655	.909
	PBC4		.810	.872
	PBC5		.766	.882
Behavioural Intention		0.95		
	BI1		.857	.946
	BI2		.899	.914
	BI3		.909	.906

modifications, our EFA revealed a structure that aligns well with other adapted TPB questionnaires in different health domains. However, the strength of item loadings and inter-item correlations may differ from those reported in other countries' versions, likely reflecting subtle cultural interpretations of the constructs. [29-31] This observation aligns with findings from other cross-cultural adaptations of TPB instruments, where linguistic and cultural variations often lead to slight differences in psychometric properties while maintaining overall validity and reliability.

Our EFA findings extracted four factors: attitude, subjective norms, perceived behavioural control and behavioural intention, which aligned with the TPB theoretical framework.[12] While the original questionnaire contained 25 items, [15] our Malay version of the IPCSU questionnaire retained 21 items distributed across these four domains: attitude (8 items), subjective norms (5 items), perceived behavioral control (5 items), and

behavioral intention (3 items). This distribution maintains adequate representation of each construct, hence preserving the questionnaire's theoretical integrity. The reduction in items aims to improve response rates and data quality while still capturing the essential elements of the TPB.

Four items (A4 and A9 from the attitude domain; SN2 and SN5 from the subjective norms domain) were removed due to a very low inter-item correlation matrix <0.3, which is unsuitable for factor analysis.

Items with inter-item correlations below 0.3 were removed as they do not contribute meaningfully to factor formation. Low correlations indicate that these items are not measuring the same underlying construct as other items in their domain, potentially introducing inconsistency or measurement error. It also indicates a weak relationship between the variables and prevents factor formation.[20] This means that the participants are not able to discriminate between the items, and the item is not effectively measuring the intended domain. Therefore, the literature suggests that the correlation coefficient should be at least 0.3 and that variables with lower correlations should be excluded from the factor analysis.[21] While removing items could potentially narrow the scope of measurement, our careful selection process ensured that the remaining items still fully represent the TPB constructs. The improved internal consistency (Cronbach's alpha of 0.95) suggests that the removal of these items may have actually enhanced the questionnaire's construct validity by creating a more cohesive set of items.

An acceptable factor loading is based on the number of participants.[21] Hence, a cut-off value of 0.45 was set. This threshold is appropriate for our sample size of 145, as Hair et al. suggest that for a sample size of 150, factor loadings of 0.45 and above are significant. All remaining items had factor loading values ranging from 0.47 to 0.80. One item (PBC5) was noted to have cross-loading into a factor other than the original. It loads into factor 2 and 3 with the values of 0.543 and 0.590. This item was retained in factor 3 as they fit better conceptually in this factor and have higher factor loading. In addition, this item is likely representing a key aspect of PBC and removing it could compromise the construct's measurement. The cross-loading may reflect the interrelated nature of TPB components in the context of PPC intentions, possibly due to the different settings of the study population. While this cross-loading presents some interpretative challenges, retaining PBC5 in factor 3 may provide the best balance between statistical results and theoretical considerations, ensuring our adapted questionnaire fully captures the complexity of PPC decision-making in the Malaysian context.

Overall, our Malay version showed higher internal consistency, (Cronbach's alpha=0.95) compared to the original (0.72), a significant improvement attributable to several factors.[15] The differences in internal consistency could also be due to variations in participants' sociodemographic characteristics between our study and the original. Our adapted questionnaire was likely better tailored to the cultural context of our participants, making the items more relevant and relatable. We also conducted two rounds of face validation, revising the questionnaire based on initial feedback before a second validation, likely enhancing item clarity and relatability. Through rigorous translation and validation, including the removal of poorly performing items, we retained only the most relevant and well-understood questions. While similar reliability improvements have been observed in other cross-cultural TPB questionnaire adaptations, our two-stage face validation process may have particularly contributed to the substantial increase in internal consistency.

This study is the first to translate and validate the TPB questionnaire on IPCSU from English to Malay. However, it has several limitations. First, although the subject-to-item ratio of 5:1 was adequate for factor analysis in this study, a larger sample size of at least 300 participants would reduce the margin of error, leading to more stable solutions. Future studies should aim for a larger, more diverse sample to improve generalisability. We recommend employing random sampling across different regions of Malaysia, including participants from various ethnic backgrounds, education levels, and age groups. Second, this study was conducted in a local university with a predominantly Malay population and

uniform education level, limiting generalisability. To address this, future research should consider multi-site studies across different universities and community settings. Furthermore, the questionnaire is currently only useful for those who understand Malay. We suggest translating and validating the questionnaire in other major languages spoken in Malaysia, such as Mandarin and Tamil, employing rigorous back-translation techniques to ensure equivalence across language versions. Third, the convenience sampling method may have introduced sampling bias. To mitigate this in future studies, researchers should consider using mixed-methods approaches, to better understand how different cultural and linguistic groups interpret and respond to the questionnaire items. Additionally, to further enhance the questionnaire's validity, we recommend conducting confirmatory factor analysis with a new sample to verify the factor structure and testing the questionnaire's predictive validity by assessing actual PPC utilisation in various settings.

CONCLUSION

The finalised Malay version of the IPCSU questionnaire is valid, reliable, and stable over time. This tool can measure the intention to use PPC services among young female adults in the reproductive age group. Intervention strategies can then be developed and targeted, particularly toward those with low intention of PPC services utilisation.

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